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San Francisco, California

1951

# THE PAN-PACIFIC ENTOMOLOGIST

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# The Pan-Pacific Entomologist

VOL. XXVII, No. 4

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## DUDLEY MOULTON

Dudley Moulton was born on a fruit ranch near San Jose, California on December 29, 1878. At the age of 73 years he died at Pasadena, California, July 5, 1951. Following a period of poor health he had recently moved from his home of long-standing at Redwood City to that of his son at San Gabriel, California.

His early interest was in agriculture and its problems and he majored in entomology at Stanford University. He studied under the noted Vernon Kellogg and was graduated with an A.B. in 1903. Three years later he received an M.A. from the same institution.

During the period 1904-1906 he was entomologist for Santa Clara County and was the first to work out the biology and control of the pear thrips, at that time a new and most serious fruit pest (Howard, 1933). His first publication was about this insect, in 1905. In the three year period which followed he was in the employ of the Bureau of Entomology, U. S. Department of Agriculture, as a Special Agent, Deciduous Fruit Investigations, studying various fruit pests in Nebraska, Missouri, Arkansas and California. In addition to his well-known publications on the pear thrips, he wrote on the California peach borer (Essig, 1931). In 1909 he described his first new species of thrips, the citrus thrips, still a well-known and important economic pest. In this same year he was appointed Deputy State Commissioner of Horticulture for California, serving in this capacity until 1915. During the greater portion of this period he was in charge of the Quarantine Division at the city and port of San Francisco. In 1915 he assumed the duties of Agricultural Commissioner for the city and county of San Francisco. As trade representative for the Sacramento Region Citizen's Council, he spent several months in 1929 in South America developing better trade relations between California and the nations to the south. As a result of this trip the Pan-American Reciprocal Trade Conference was held in Sacramento in 1930.

In July 1931, Mr. Moulton was appointed Director, Department of Agriculture, State of California, which position he held until January 1933. While in office at Sacramento he created a Division

of Entomology and Pest Control and was active in developing the Agricultural Marketing Act (Tucker, 1931).

To professional entomologists, both in this country and abroad, he was known as a leading authority on the insect order Thysanoptera. As a result of his early work on the pear and citrus thrips he began collecting thrips and developed a lasting interest in their taxonomy. Following the publication of his Catalog of North American Thysanoptera in 1911 he gained wide recognition, expanded his world-wide collection, catalog and library. From 1926 on he published steadily and his papers totaled 75 (Bailey, 1949) which include descriptions of 47 new genera and subgenera and 480 new species and varieties. His imposing collection and library, which are deposited in the Entomology Department at the California Academy of Sciences, Golden Gate Park, San Francisco, are continually referred to by authorities and students of this group of insects. There are some 25,000 prepared slides, and much unmounted material.

He also helped and encouraged many contemporary and younger workers, notably F. Andre, P. R. Jones, A. C. Mason, A. C. Morgan, J. R. Preer, K. Sakimura, J. B. Steinweden, J. G. Watts, and the writer. In this respect he was most generous and hospitable in receiving fellow scientists into his home at Redwood City, making available his collection and library, and in loaning valuable specimens for study. His uppermost thought was to share his findings and further the scientific knowledge on Thysanoptera. His correspondence was world-wide and he remained in touch with entomologists in many countries by a prompt and generous exchange of specimens and personal helpful notations. His name will remain prominent in entomological literature.

His writings on subjects other than thrips were as follows:

1905. Report of the County Horticultural Commissioner. Santa Clara County. First Bien. Rpt., Comm. Hort., State of Calif. for 1903-04, pp. 177-180.
1911. The California peach tree borer. Calif. Cultivator, 36:734.
1911. The California peach tree borer. U. S. Dept. Agric., Bureau Ent., Bull. 97, part IV, pp. 65-69, pls. VIII - IX.
1931. Financing perishable shipments. First Pan-Amer. Recip. Trade Conf. Monthly Bull., Dept. Agric., State of Calif. 20(9) :88-91.
1932. The California Plan: Its origin and development. Monthly Bull., Dept. Agric., State of Calif. 31(4-6) :248-254.

At various times he was a member of the following societies: Sigma Xi, Pacific Coast Entomological Society, American Association of Economic Entomologists, California Academy of Sciences and a Fellow in the Entomological Society of America.

Mr. Moulton is survived by his wife, Maude C. Moulton, two sons, Robert C. and Kenneth C. Moulton, and two sisters, Josephine and Lina.

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1931. *A History of Entomology*. Macmillan, New York, pp. 98, 99, 238, 240, 886.

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1933. *Fighting the Insects*. Macmillan, New York, pp. 159-160.

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1931. The new Director of Agriculture. *Monthly Bull., Dept. Agric., State of Calif.* 20 (7):418.

Stanley F. Bailey,  
University of California, Davis

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BULLETIN OF ANIMAL BEHAVIOUR (Journal of the Association for the Study of Animal Behaviour). Cromwell House, Huntington, England.

This journal began publication in October, 1938, and parts of Volume 1 have appeared at irregular intervals. The most recent, No. 9, March, 1951, is largely entomological. It contains translations from the German of three articles by K. von Frisch: 1) Solved and unsolved problems of bee language (from *Die Naturwissenschaften*, 1948, Heft 1:12-23 and Heft 2:38-43), 2) The polarisation of light from the sky as an orienting factor in the dances of the honey bee (from *Experientia*, 5:142-148. 1949), and 3) The sun as a compass in the life of honey bees (part of summary only, from *Experientia*, 6:210-221. 1950).

Number 5, December, 1947, contains "The dances of the honey bee" by von Frisch, with a preface to the English translation by W. H. Thorpe. It is available at the above address for 2s. 6d.; No. 9 costs 7s. 6d.—H. B. L.

ZOOLOGICAL NOMENCLATURE: NOTICE OF PROPOSED  
SUSPENSION OF THE RULES IN CERTAIN CASES FOR  
THE AVOIDANCE OF CONFUSION AND THE VALIDATION  
OF CURRENT NOMENCLATORIAL PRACTICE (A. (n.s.) 9)

Notice is hereby given that the possible use by the International Commission on Zoological Nomenclature of its plenary powers is involved in applications relating to the under-mentioned names included in Parts 9/10 of Volume 2 of the *Bulletin of Zoological Nomenclature*, which will be published on 15th August, 1951:—

- (1) *Entamoeba* Casagrandi & Barbagallo, 1895, *Endamoeba* Leidy, 1879, and *Poneramoeba* Lühe, 1909 (Class Rhizopoda) (action designed to validate existing practice) (pp. 243-281) (File 185).
- (2) *dentatus* Diesing, 1839 (as published in the binominal combination *Stephanurus dentatus*) (Class Nematoda) (question whether this name should be preserved for the kidney worm of swine) (pp. 282-293) (File 188).
- (3) *Eysarcoris* Hahn, 1834 (Class Insecta, Order Hemiptera) (proposed validation of existing nomenclatorial practice) (pp. 294-5) (File 212).
- (4) *acuminata* Ioff & Tiflov, 1946 (as published in the combination *Rhadinopsylla* (*Rectofrontia*) *acuminata*) (Class Insecta, Order Siphonaptera) as applied to species No. 68 (proposed elimination of homonymy caused by printer's error) (pp. 296-7) (File 386).

Any specialist who may desire to comment on any of the foregoing applications is invited to do so in writing to the Secretary to the International Commission (address: 28 Park Village East, Regent's Park, N. W. 1. England) as soon as possible. Every such comment should be clearly marked with the Commission's File Number as given in the present Notice.

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THE SUCKING LICE, by G. F. Ferris. This 320-page book, the first of the Pacific Coast Entomological Society's "Memoir Series", was published on October 19. It will be reviewed in a later number of this journal.

R  
NOTES ON INSECTS ASSOCIATED WITH LUPINUS  
POLYPHYLLUS LINDL. IN THE PACIFIC NORTHWESTL. P. ROCKWOOD<sup>1</sup>*Bureau of Entomology and Plant Quarantine, Agricultural  
Research Administration, United States Dept. of Agriculture*

About thirty years ago the writer, with some assistance,<sup>2</sup> studied the insects associated with a native lupine, *Lupinus polyphyllus* Lindl. (Piper and Beattie 1915). This lupine frequently occurs on the edges of wet unplowed meadows in the Tualatin Valley, a western arm of the Willamette Valley in Oregon. The stems, sometimes four or five feet tall, with their long racemes of pale violet flowers and large palmate leaves are conspicuous in the plant associations in which they occur. The stems are  $\frac{3}{8}$  inch or more in diameter, thick-walled, and hollow except for a few inches of solid pith at the base.

Now that the writer has the time and inclination to return to his notes on the interesting group of insects associated with this plant, this lupine has disappeared from some of the nearby places where it formerly was abundant and in other places it has been damaged by the trampling of cattle. Hence the deductions from the original observations on the habits of certain of the insects infesting it, which were doubtful in some cases, cannot now be verified. However, as no information has been published on most of the species of insects, at least five of which were not known before our material was sent to taxonomists, it seems worth while to record the original observations.

The abundance of nicks in the edges of the leaflets first attracted the writer's attention to this plant in May, 1918. It was soon noted that the nicks were caused by the feeding of a large sitona beetle, which was identified as *Sitona californica* Fahraeus by W. D. Pierce in 1919. Upon further investigation in May, 1919, stem maggots were found in the bases of the flower stalks and a lepidopterous borer, which caused the large palmate leaf or the flower raceme to wilt, was present in the stems. Later other maggots were found in the stems and lepidopterous and coleopterous miners in the roots. In all, 10 species of probably injurious insects were

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<sup>1</sup>Retired October 31, 1948.<sup>2</sup>Mrs. S. K. Zimmerman (née Keen) and Max M. Reeher.

noted on this host plant. In addition, a small, black sphecoid wasp and a leaf-cutting bee with its nearly-related inquiline were found utilizing the large stems as nesting places, after the stems had been damaged by other insects.

## LEPIDOPTERA

### PAPAPEMA PERTINCTA Dyar

Of the Lepidoptera the most interesting species was a stem borer that Dyar (1920) described as *Papaipema pertincta* from moths that had been reared from this host plant. The first indication that larvae of this species were at work was the wilting of the large leaves or the flower stalks in May. When the stems were split, the small larvae, probably then only in their first or second instar, were discovered actively feeding up and down inside the hollow stems, eating into the side walls as they went, even up close to the tip of the flower stalks. In spite of their small size, the larvae seriously affected the circulation in the large stems, causing them to wilt.

At this time the larva was a very active semi-looper, Van Dyke-brown with conspicuous whitish dorsal and subdorsal lines on the last two thoracic and last five abdominal segments, with the dorsal line only faintly indicated on the intervening segments. The thoracic shield and head were shining straw-color with a Van Dyke-brown streak on the sides of the face prolonged onto the thoracic shield.

As the larvae continued to work, the stems of the plant often broke off at points weakened by their feeding. By July the larvae were full-grown and were located in the stalk at the crown. This part of the stalk was originally solid pith but had been eaten out to form a pupation chamber. In each case a hole for emergence of the moth had been eaten in the stem well above the pupation chamber and about an inch above the surface of the ground. Frass had been expelled through this hole.

On August 7, 1924, a prepupal larva was described as follows: 36 mm. long by 6 mm. wide, dully shining, dirty white, without lines; head chestnut brown, thoracic shield auburn with black lateral margins, the median pale line faint; setae black on dark brown spots, spot around seta I, on abdomen, about three times as large as that around II except on abdominal segment 8 where both are transverse and subequal, the transverse oval spots around setae I and II cover most of the dorsum on abdominal 9, spot around seta III about like the one around II, that around III<sup>a</sup> small

but distinct, the one around IV larger than the one around I, those around setae V and VI large, subequal, but paler; anal shield raw umber; tarsi almost black; proleg plates large but pale; claws black; spiracles black.

Pupation occurred in early August and the moths emerged in September. This species was parasitized in the early stages by an undetermined species of *Sagarites* and in the later stages by the braconid *Microplitis gortynae* Riley (determined by C. F. W. Muesebeck in 1922), the gregarious larvae of which emerged from the prepupal larva and spun their cocoons in the pupation chamber.

#### HYSTRICOPHORA PARADISIAE Heinrich

Another lepidopteron was a miner in the roots. This species did not come to our attention until we had dug up and caged the crowns and part of the roots of several of the plants to obtain pupae of the stem borer. Considerable numbers of pupae were found the following spring projecting from mines in the roots. A few of these root borers, in the larval stage, were later found in roots of the older plants. Pupal cases, with one end stuck in the ground and standing upright but empty, were found around the plants in the field. In the laboratory, moths emerged in May of the year following collection. Upon examination of the root crowns from which they had issued, it was found that very little sound plant tissue was left. The pupal chambers had been formed just under the surface of the root and were lined with white silk. An exit hole had been formed, through which the pupa had forced its way before the moth emerged. This species was determined by Carl Heinrich in 1922 as *Hystricophora paradisiae*, and was described by him (Heinrich, 1923) from specimens taken in Paradise Valley on Mt. Rainier in Washington.

#### COLEOPTERA

##### SITONA CALIFORNICA Fähræus

The coleopteron *Sitona californica* was usually rather abundant wherever this lupine occurred. The typical feeding notches of the adults on the edges of the leaflets were often so numerous as to give the leaflets the appearance of being irregularly dentate. Copulation and oviposition were observed in May. The eggs were often laid on the stems near the ground. The short-oval (nearly round) eggs are white at first but turn black if fertile (like those of all other sitonas known). The larvae feed on the large nodules on the roots.

These nodules are much larger than those on other leguminous plants, and this species of *Sitona* is larger than any other found in the region. The larvae reach maturity in July and pupate near the surface of the ground. The adults probably emerge in July.

#### ANOPLODERA INSTABILIS Haldeman

Occasionally coleopterous larvae were found in mines in the roots in July and August. These larvae were recognized as cerambycids, but the species was not reared until May 30, 1928, when adults emerged from roots collected in August, 1927. The adults were determined as *Anoplodera instabilis* by W. S. Fisher in 1930.

#### APION sp.

An undetermined species of *Apion* was observed on the flowers of the lupine in May and June.

#### DIPTERA

##### EREMOMYIA sp.

Some of the most interesting insects associated with this plant were Diptera. In May, 1919, a few maggots were found in the bases of the flower stalks near the ground level where the stem was solid pith. These maggots pupated on May 15 and two flies emerged on June 13. One of the flies was sent to Washington and the other was given to Frank R. Cole who in turn sent it to J. R. Malloch along with a specimen that he had obtained by sweeping. J. M. Aldrich determined the specimen sent to Washington as *Eremomyia* in 1920. It is not known whether Malloch, who was working on the genus at that time, described the species.

#### PHYTOMYZA ALBICEPS Meigan

On July 8, 1919, several small puparia were collected in debris inside the hollow part of the stems where papaipema larvae had also worked. On July 5, 1920, both larvae and puparia were observed and it was noted that the larvae had worked from the solid pithy core of the stem near the crown up the inside of the hollow stems, in the side walls, for two or three inches, causing a rusty color in the affected plant tissues. Flies emerged in March and April from material that had been kept over winter in the laboratory. These flies were determined as *Phytomyza albiceps* by J. M. Aldrich in 1921.

## CHYLIZA LEGUMINICOLA Melander

On July 8, 1919, crowns and lower parts of the stems containing puparia were collected. These puparia were firmly held in the tissues of the crown, which the larvae had apparently mined. Adults emerged in March of the following year. The flies were swept from the host plants in April. Melander (1920) described this species from the writer's material as *Chyliza leguminicola*. In July, 1921, Miss Keen noted the larvae working in the base of the stems and in the crowns. In August, 1921, the writer collected infested crowns from which 39 individuals of this species and 49 specimens of another species emerged the following spring. On August 7, 1924, it was noted that the chyliza larvae worked in the crown of the lupine where the stem was originally solid. When full-grown and ready to pupate, they often mined downward into the root. The flies rarely attempted to fly when emerging in the laboratory but were quick to jump, like some chalcids.

## LONCHAEA HIRTITHORAX Aldrich

On August 19, 1921, large numbers of maggots were found in a writhing mass where the stem of the lupine joined the crown, a part that is solid in undamaged plants. These larvae were thought to be *Chyliza* sp., but they were found to be of another species. In all, 49 specimens were reared. The species was described as *Lonchaea hirtithorax* by Aldrich (1925). On August 7, 1924, the lonchaea larvae were observed feeding in the thick walls of the lupine stems, near the crown but in the hollow part. They were not so abundant as they had been in 1921. By the time this species was feeding actively, the host plant had matured its seed and was on the decline. This species was still in the larval stage in August when chyliza larvae had pupated.

## LYCORIA sp.

In May, 1922, *Lycoria* of an undetermined species were reared in considerable numbers from the roots and crowns that had been collected the previous summer.

## HEMIPTERA

## MACROSIPHUM ALBIFRONS Essig

The aphid *Macrosiphum albifrons* Essig has also been found on this lupine.

## HYMENOPTERA

## SOLIERELLA SIMILIS (Bridwell)

On August 17, 1920, a few nests of a sphecoid wasp were found in the flower stalks that had been broken off, part way down from the top, where they had been weakened by the feeding of *papaipema* larvae. One of these nests was in a stalk that had been broken near the crown, where it had been weakened by stem maggots, and was lying almost recumbent. In this case the wasp must have had to reverse its usual habit of forming its cells from the bottom up. The brood chambers were usually three to four in number and filled with three to six paralyzed but still living early stage grasshoppers of the genus *Melanoplus*, packed around with pellets of earth. The flimsy partitions between the cells, and the filling above the last cell, were formed of chaff, grass and weed seeds, small pieces of twigs, bird and insect excreta, and even a few very small berries. In one nest all the grasshoppers had been consumed and all the wasp larvae were in cocoons coated with fine dirt from the earth pellets. In another nest the two lowest chambers contained cocoons, the next higher chamber had a well-grown larva consuming one of the last grasshoppers, and the chamber nearest the top contained four grasshoppers with a small larva attached to one of them.

On August 24, 1920, two nests were discovered in lupine stems in a different locality from that of August 17. One of these nests was similar to those previously found and contained only cocoons, but the other was constructed differently, with only two large brood chambers, which contained more vegetable debris than earth pellets and 31 grasshoppers with only two well-grown larvae. The latter nest may have belonged to another species of wasp.

On August 19, 1921, Miss Keen found several of these nests in the lupine stems. All the wasp larvae were in cocoons and the provisions of grasshoppers had been consumed. Wasps that emerged from this material on June 28, 1922, were determined by S. A. Rohwer as *Silaon* n. sp. in 1922 and in 1924. These specimens are now in the U. S. National Museum under the name of *Solierella similis* (Bridwell), having been so identified by Francis X. Williams.<sup>3</sup> A few parasites were also reared from cocoons of this wasp and were determined as *Tetrastichus* n. sp. by A. B. Gahan in 1923.

<sup>3</sup>Letter from C. F. W. Muesebeck, dated August 16, 1949.

On August 7, 1924, the writer found a nest that measured 13 inches over all and had 10 cells. The five lowest cells contained cocoons and the next three contained larvae. In the last cells there were 8 grasshoppers in one and 6 in the other, but no wasp larvae or eggs. These two cells were close together, with only a thin layer of trash between them and between the lower of the two and the next cell. The top end of the nest was filled with lumps of earth and other debris, dropped in haphazardly. The grasshoppers showed slight reflex movements when pressed on the sternal plates. Evidently these wasps began work early in July soon after emergence from the cocoons in which they had overwintered. At that time the grasshoppers would still be rather small in the wet places where the lupine grows as they hatch later in that area than elsewhere. The grasshoppers in the nests, probably *Melanoplus femur-rubrum* Degeer, were in the early nymphal stages.

MEGACHILE BREVIS Say, and COELIOXYS sp. near MOESTA Cresson

On August 7, 1924, the writer found a nest of a leaf-cutting bee in a hollow stem that had about one-third of the top broken off, probably because of damage by the *Papaipema* stem borer. This nest was  $2\frac{3}{4}$  inches long and contained five cells. The partitions between the cells were made of three green leaves on top of each other with two pieces of rose petal, laid very closely together, as a cap to the cell below. The completed nest was about one inch below the opening of the hollow stem, and the stem above the last cell was filled with pieces of green leaves dropped in haphazardly. Another similar nest in the course of construction was observed. The last cell was formed of rose petals, still bright, and was open at the end and empty. Two completed cells below contained "bee bread" and one egg each. The eggs were attached to the side of the cell a few millimeters above the food. A newly hatched larva was seen but it was met and killed by a larger larva with large strong jaws, which had worked up through the "bee bread" in the bottom of the cell. In July of the following year, five bees of two species emerged from the undamaged nest. In 1927 Miss Grace Sandhouse determined one of these as *Megachile brevis* Say and the other four as *Coelioxys* sp. near *moesta* Cress. The latter species is an inquiline, and the larva with strong jaws noted above was probably this insect.

An intensive study of *Lupinus polyphyllus* would doubtless reveal other insects closely associated with it. The notes given in

this paper indicate that ecological studies of the insects associated with plants native to the Pacific Northwest would increase our knowledge of the insects of that region, some of which might eventually be of considerable importance to economic or ornamental plants.

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1915. Flora of the Northwest Coast, p. 215.

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#### THE FEMALE OF PSEUDOMETHOCA ANTHRACINA (FOX) (Hymenoptera: Mutillidae)

Evidence has been obtained to substantiate Mickel's contention<sup>1</sup> that *Pseudomethoca harpalyce* (Fox)<sup>2</sup> is the female of *P. anthracina* (Fox)<sup>3</sup>. An analysis of the distributional patterns of the California *Pseudomethoca* fauna has revealed that those of *anthracina* and *harpalyce* are virtually superimposable. In the fall of 1947 at Antioch, California, a freshly emerged female (*harpalyce*) was caged and within a short time a male (*anthracina*) was actively attempting to enter the cage. On September 8, 1948, at the same locality, the sexes in question were observed and taken in copulo. In view of the above evidence, *Mutilla* [= *Pseudomethoca*] *harpalyce* Fox is regarded as a synonym of *Sphaerophthalma* [= *Pseudomethoca*] *anthracina* Fox.—PAUL D. HURD, JR.

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<sup>1</sup>Proc. U. S. Nat. Museum, 1924, vol. 64, p. 21.

<sup>2</sup>Trans. Amer. Ent. Soc., 1899, vol. 25, p. 227.

<sup>3</sup>Ent. News, 1892, vol. 3, p. 172.

NEW SPECIES OF ORIENTAL ENDOMYCHIDAE, WITH  
REMARKS ON SOME PREVIOUSLY KNOWN SPECIES

(Coleoptera: Endomychidae)

H. F. STROHECKER

*University of Miami, Florida*

Through the kindness of E. C. Van Dyke and H. B. Leech I have recently been able to study many specimens of Endomychidae in the collection of the California Academy of Sciences. Most of these are from the Orient; of unusual interest are examples collected in Formosa, Hainan and southern China, many of them from the J. L. Gressitt collection.

## MYCETINA MARGINALIS (Gebler)

*Lycoperdina marginalis* Gebler, 1830, Cat. Coleopt. Siberiae Occid. Th. 2.

*Mycetina obliquesignata* Gorham, 1873, Endomycici Recitati, p. 44.  
*Engonius konumaensis* Ohta, 1931, Jour. Faculty Agric. Sapporo, 30, p. 220.

*Phaeomychus konumaensis* Chujo, 1938, Trans. Nat. Hist. Soc. Formosa, 28, p. 394.

Ohta (1931:220) did not properly recognize the genus *Engonius*; the three species referred to it by him belong to other genera. As Chujo has pointed out (1938:398), *Engonius taitoensis* and *E. baibaranus* of Ohta are the two sexes of *Eumorphus quadriguttatus formosanus* Pic, which occurs also on Hainan. *E. konumaensis* Ohta was referred to *Phaeomychus* by Chujo (1938:394), a justified move. But the generic name *Phaeomychus* Gorham is not available here since its type, *Endomychus rufipennis* Motschulsky, is a species of *Mycetina*. In 1830 Gebler described *Lycoperdina marginalis* from Siberia and the species has not been recognized since. In my collection there are four specimens labeled "Sutschan, Ussuri", and I have seen one other from Transbaikal. It seems certain that the above synonymy is applicable.

## ENGONIUS MUSHANUS (Ohta)

In the California Academy collection is a specimen taken at Wong Sa Shui, S. Kiangsi, S. China, by J. L. Gressitt, which agrees exactly with Ohta's description and figure of *Brachytrycherus*

*mushanus*. The specimen is, however, an *Engonius*. On the basis of Ohta's diagnosis I had already placed *mushanus* under *Engonius* in

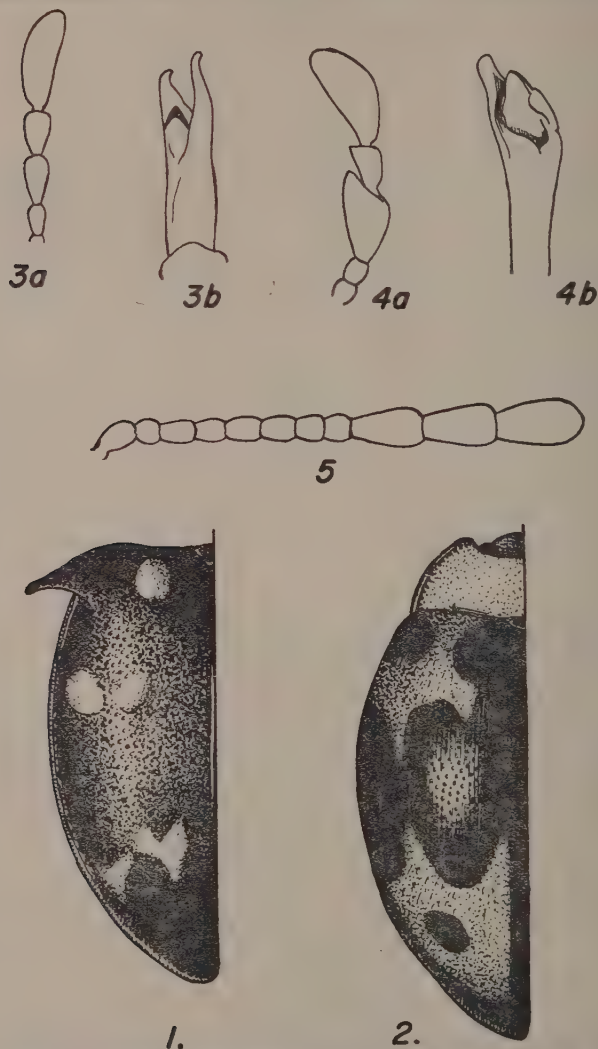


Fig. 1. *Amphisternus astarte*, elytron. Fig. 2. *Melichius erotylodes*. Fig. 3a. *Saula longior*, club of antenna. Fig. 3b. *S. longior*, aedeagus. Fig. 4a. *Danae chinensis*, club of antenna. Fig. 4b. *D. chinensis*, aedeagus. Fig. 5. *Melichius pachycerus*, antenna.

my private catalogue and this seems vindicated. The subgeneric name *Ohtaius* Chujo falls as a synonym of *Engonius*.

#### PARINDALMUS TONKINEUS Achard

Three other specimens of unusual interest to me were collected at Tai Au Hong, S. Kiangsi, S. China, by Gressitt. They agree perfectly with Achard's description (1922:29) of *Parindalmus tonkineus*. Arrow (1928:351) expressed the opinion that Achard's *Parindalmus* was the same as *Pedanus* Gerstaecker, and the three specimens now at hand corroborate his judgment. However, since Schoenherr used the generic name *Pedanus* in the Curculionidae in 1823 it appears that *Parindalmus* Achard must be used for the species formerly referred to *Pedanus* Gerstaecker.

#### *Amphisternus astarte* Strohecker, new species

Black, the elytra with subcupreous reflections and each with a broad, recurved humeral spine and five reddish-yellow callosities. Of these the most anterior is rounded and near the scutellum; the next two are subtriangular in outline and are situated in a transverse line before the middle; the remaining two callosities occupy a transverse line on the last third of the elytron. Length 10 mm.

Head coarsely and thickly punctured, with an impression near each antennal base. Antennae slender, third segment almost as long as fourth and fifth combined; club moderately broad, compact, strongly flattened. Pronotum transverse, its front angles much thickened, extended beyond the eyes and acutely rounded; hind angles slightly acute, hardly produced. Disc of pronotum finely, sparsely punctured, with a feeble median longitudinal groove and two shallow impressions on each side. Basal foveae short and deep, basal transverse sulcus deep. Elytra as described above, rather coarsely and closely punctured at base, more finely toward apex. Prosternum broad, its intercoxal process deeply forked. Mesosternum strongly transverse. Abdominal sternites coarsely and thickly punctured except the smooth posterior edge of each. Femora clavate, tibiae simple.

*Holotype*: Female, BUKAI, FORMOSA, VI-14-32, L. Gressitt (Calif. Acad. Sciences).

The holotype is the only specimen I have seen. This is a very distinctive species, distinguishable from all others described by its recurved humeral spines with absence of other elytral spines or verruculae.

#### *Ancylopus concolor* Strohecker, new species

Head, legs and antennae black, pronotum, elytra and undersurface reddish-brown, the sides of metasternum and abdomen infusate. Length 6.5 mm.

The head is coarsely and closely punctured, eyes prominent and coarsely granulate. Antennae with third segment almost twice length of fourth; club loose-jointed, narrow, not much flattened. Pronotum transverse, broadest at mid-length, slightly narrowed to the produced and acutely rounded front angles and to the hind angles, which are approximately right-angled. Lateral sulci linear, not reaching to middle of disc; basal transverse sulcus deep, extended laterally to hind angles. Disc sparsely punctate, with several large, punctiform foveae on each side of middle. Elytra coarsely and rather closely punctured. Prosternum short and very narrow, the front coxae contiguous. Mesosternum narrow, middle coxae approximate. Fifth abdominal sternite broadly rounded at apex and minutely v-excised at middle of hind margin. Front tibia incurved and enlarged at apex, with row of minute tubercles on inner face. Middle tibia incurved and enlarged near apex. Hind tibia straight, somewhat enlarged at tip and with a dense brush of setae at its inner apical angle.

The structure of the tibiae and fifth abdominal sternite suggest that the specimen is a male. Dissection failed, however, to yield an aedeagus. Possibly this organ was extruded, and was broken off after drying.

*Holotype*: Sex? TAI AU HONG, S. KIANGSI, S. CHINA, VII-7-36, J. L. Gressitt (Calif. Acad. Sciences).

Apparently the only names hitherto correctly referable to *Ancylopus* are *melanocephalus* Olivier and its synonyms and color varieties. The other species placed by their describers in *Ancylopus* are better relegated to *Indalmus* on the basis of mesosternal structure. In *Ancylopus* the mesosternum is strongly narrowed between the middle coxae, while in *Indalmus* it is about parallel. *Ancylopus melanocephalus* has the elytra extensively marked with black; in the male the front tibia is strongly toothed; in the female the pronotum has an arcuate, transverse groove at mid-length.

#### *Mycetina minor* Strohecker, new species

A small species of the *brevicollis* group but recognizable by its somewhat elongate, subparallel form. Entirely castaneous except the antennae and eyes, strongly shining. Antennae stout, segment 2 very small and globose, 3 a little longer than broad, 4 and 5 about quadrate, the remainder transverse. The antenna has no distinct club but is gradually broadened from the third segment outward. Segments 1 and 11 clear ferruginous, 2 to 5 dusky, 6 to 10 black. Length 3.2 mm.

Pronotum brilliant, its disc not perceptibly punctured. Basal foveae narrowly triangular, prolonged to middle of disc. Basal

transverse sulcus broadly excavated, leaving a basal marginal area of considerable width. Elytra at base subequal in width to pronotum, their umbones moderately prominent and concolorous with the disc. From their base the elytra are slightly widened to about their mid-length, thence gradually narrowed and evenly rounded at tip. Disc of elytra finely, sparsely punctured, the punctures thicker near the suture. Represented only by the holotype.

*Holotype*: Sex? TONDANO, N. CELEBES, IV-1-32, van Braekel (Calif. Acad. Sciences).

The most closely related species are *M. brevicollis* Gorham and *M. globosa* Arrow of Borneo. Both these species have the elytra short and subglobose, with the umbones very prominent and of yellow color.

#### *Encymon valgus* Strohecker, new species

Head and pronotum dark red, almost black, shining. Elytra long-oval, deep indigo in color, moderately convex (for the genus), a little flattened above and with moderately broad side margins. Length 7 mm.

Since the species of *Encymon* are so similar in their general structure it seems futile to do more than note the features, particularly those of the male, characteristic of the present species. In its overall appearance this insect resembles *E. immaculatus* (Montruzier) but the front angles of the pronotum are less produced and the elytra less convex and more broadly margined than in *immaculatus*. In the holotype male of *valgus* the front tibia is simple, the middle tibia strongly incurved near its apex and with a row of small tubercles on its inner face, the hind tibia undulate. *Encymon violaceus* Gerstaecker shows similar tibial modifications but is easily identified by its finely muricate, opaque pronotum and highly convex elytra.

*Holotype*: Male. BALBALAN, LUZON, PHILIPPINE ISLANDS (author's collection).

*Allotype*: Female. Data as for type and wholly similar in appearance except the tibiae are all simple. Three additional females appear to belong to this species and are designated paratypes. One is labeled "Montalban, Luzon", another "Subuagrn, Luzon" and the third "Philippinen, Luzon".

#### *Encymon truncaticollis* Strohecker, new species

Head and pronotum red, elytra deep violet, oval and moderately convex, a little flattened above and with the sutural border depressed. Pronotum with front angles very short and obtusely rounded. Length 7 mm.

Head between the eyes with two rounded impressions. Pronotum distinctive, its front angles much rounded and not produced, its anterior margin strongly sinuate. Hind angles right. Disc of pronotum abruptly convex toward middle and with a fovea on each side in front of middle; lateral sulci long, linear; basal transverse sulcus deep. Elytra as described, their side margins moderately broad. Front tibia simple, middle tibia a little incurved toward tip, hind tibia weakly undulate.

*Holotype*: Male. MT. MAKILING, LAGUNA, PHILIPPINE ISLANDS, XI-1-32, F. C. Hadden (Calif. Acad. Sciences).

A single female specimen collected by Hadden on Mt. Makiling (VI-29-31) may be of this species but the pronotum has the front angles decidedly acute although little produced, and the hind angles are acute. The disc of the pronotum is evenly and slightly convex as is usual in the genus. The elytra conform closely to the description given for the holotype. An imperfect male specimen in my collection from Balbalan, Luzon, Philippine Islands, is designated a paratype.

#### ENCYMON VIOLACEUS CUPREATUS Mader

In my collection are four specimens from the type locality, Banguay Island. These specimens came from the Staudinger collection and are undoubtedly part of the original material from which came the type series of Mader. I feel confident in saying that *cupreatus* Mader is merely the teneral phase of *violaceus* Gerst.

#### *Danae chinensis* Strohecker, new species

Very similar to *Danae denticornis* (Gorham) but notably larger. Head, antennae, pronotum, legs and under surface of prothorax black; elytra and abdominal sternites ferruginous. Entirely clothed with a fine, fairly dense, recumbent pubescence. Length 4.25 mm.

Head deeply sunken in the prothorax, the eyes partly hidden. Antennae with segment 9 much thicker and broader than 10 or 11 and internally acute at apex; segment 10 small, its outline almost a right triangle; 11 somewhat reniform, twice as long as broad. Pronotum broadest before middle, abruptly rounded to the very obtuse front angles, narrowing posteriorly but expanding slightly to the feebly acute hind angles. Basal foveae short, deep and oblique; basal transverse sulcus fine and shallow. Elytra long-oval and subparallel. The tibiae are all straight and otherwise unmodified.

*Holotype*: Male. HONG SAN, S. E. KIANGSI, CHINA, L. Gressitt (Calif. Acad. Sciences). Another male with the same data as that of the holotype is designated a paratype and is in the author's collection.

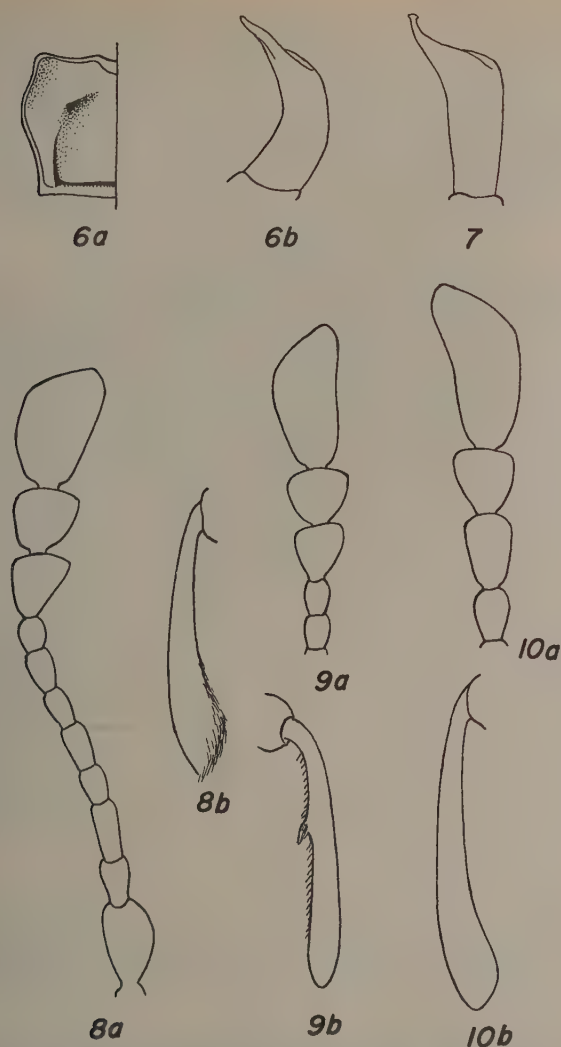


Fig. 6a. *Encymon truncaticollis*, pronotum. Fig. 6b. *E. truncaticollis*, aedeagus. Fig. 7. *Encymon valgus*, aedeagus. Fig. 8a. *Saula luzonica*, antenna. Fig. 8b. *S. luzonica*, front tibia of male. Fig. 9a. *Saula dentipes*, club of antenna. Fig. 9b. *S. dentipes*, front tibia of male. Fig. 10a. *Saula longiclava*, club of antenna. Fig. 10b. *S. longiclava*, front tibia of male.

The male of this species may be distinguished from the same sex of *denticornis* by the absence of an internal tooth on the ninth antennal segment. Identification of females may be more difficult. I have associated no females with the males described. The Academy collection contains two males of *denticornis* from Hainan and four females from Kwantung and Fukien Provinces, which I have also referred to *denticornis*.

### *Saula longior* Strohecker, new species

Among the known species of *Saula* the present one is unusual in its elongate form and long antennae, in which features it resembles *S. filicornis* Arrow of the Philippines. Even the aedeagi of the two species do not offer differences of major order. The legs in *longior* are of the same tawny color as the rest of the insect while in *filicornis* the legs are usually mostly black. I have, however, specimens of *filicornis* from Mindoro and Masbate which have the legs entirely tawny. Perhaps the best feature separating the two species is the shape of the last antennal segment. In *filicornis* it is somewhat less than twice as long as broad and subtruncate at apex, thus presenting a narrowly triangular outline. In *longior* it is twice or more as long as broad and the apex is rounded. Other male features in which the two species resemble each other are the slightly curved front tibia and the roundly excised fifth and sixth abdominal sternites. The sixth sternite is greatly reflexed on each side, embracing the pygidium, which is vertical. While the males of some other species of *Saula* have the pygidium so exposed none of those described show the great degree of reflexion of the sixth seen in *longior* and *filicornis*. Length 4 mm.

*Holotype*: Male. MOTHRONWALA, DEHRA DUN, U. P. [INDIA], IX-16-32, B.D. Saklani (Calif. Acad. Sciences).

### *Saula dentipes* Strohecker, new species

Small, with the pronotum and elytra more convex than is usual in the genus. Ferruginous except the eyes, distal seven or eight antennal segments, tibiae and extremities of femora, which are black. Clothed with a sparse, tawny, semi-erect pubescence. Length 3 mm.

Antennae stout but fairly long; segment 2 a little longer than broad; 3 slender; 2 to 7 subequal in length but increasing in breadth from 4 outward; 8 a little shorter than 7 and subglobose; 9 and 10 very similar in size and shape, each about as broad as long; 11 widely blade-shaped, equal in length to 9 and 10 combined. Pronotum a little more than half again as broad as long, front angles short and obtuse, hind angles right. Sides of pronotum parallel behind, widest

in front of middle. Elytra notably broader at base than pronotum, a little widened to about mid-length, thence tapering and somewhat attenuate behind; umbones not prominent.

Front trochanters subtriangularly elevated; front tibia with a small tubercle on its inner face before mid-length. The tubercle bears a dense tuft of hairs, appearing as an acute tooth. The type is unique.

*Holotype*: Male. CABUGAO, N. LUZON, PHILLIPINE ISLANDS (author's coll.).

*Saula luzonica* Strohecker, new species

Very similar to the preceding species in form and coloration but distinguishable on the basis of antennal structure and tibial characters of the male.

Antennae with segment 1 massive, a little longer than broad; 2 much thinner than 1, a little longer than broad; 3 equal in breadth to 2 but longer; 4 and 6 subequal to segment 2 in breadth and length; 5 and 7 each equal in length to 6 but distinctly broader; 8 subglobose; 9 as broad as long; 10 approximately equal to 9; 11 ovoid, broader than 10 and about as long as 9 and 10 together. Front tibia incurved and enlarged at apex; front trochanters normal; middle tibia feebly curved; hind tibia straight.

*Holotype*: Male. MANILA, PHILIPPINES (author's coll.). *Allotype*: Female. Manila, Luzon, P. I. (author's coll.). Differs from the holotype only in the tibiae, which are all straight and otherwise unmodified.

The following specimens are designated *paratypes*: Four males and two females from Manila; one male and one female from Cabugao, Luzon; one male and one female from Los Banos, Luzon; one female from Montalban, Luzon; one female from Mt. Makiling. A male from Polillo and a female from Mt. Banahao, Luzon, are very similar but seem to present some small structural differences.

*Saula longiclava* Strohecker, new species

A small insect generally similar in appearance to the two preceding but more highly convex and with the umbones of elytra more prominent. Dark red-brown, shining, clothed with a sparse pubescence. Tibiae black. Length 3.5 mm.

The stalk segments of the antennae resemble those of the two preceding species but the club presents adequate differences for identification. The first club segment is considerably longer than broad; the second is about equal in length to the first but broader; the last is elongate-oval, longer than the first two combined. The front tibia is flattened on its inner face at middle, beyond this point gradually incurved.

*Holotype*: Male. DAPA, SURIGAO, PHILIPPINE ISLANDS. (author's coll.). *Allotype*: Female; data as for type.

The above description applies to the allotype except that its front tibia is straight. I have seen no other material.

*Meilichius pachycerus* Strohecker, new species

Short-oval in outline, highly convex; ferruginous with metallic sheen, lateral areas of pronotum and elytral umbones yellowish, meso- and metasterna infuscate. Antennae stout, segments 1 to 5 ferruginous, 6 infuscate at apex, 7 to 10 black, 11 black with its apical half yellow. Length 3.8 mm.

Antennae stout, about half as long as the body, gradually increasing in thickness from base to apex; segments 3 to 6 a little longer than broad; 7 and 8 quadrate; 9 to 11 each considerably longer than broad, their combined length equal to that of the preceding seven together. Pronotum with its front angles produced and acute, its sides lightly curved and gradually divergent to the approximately right hind angles, its posterior margin feebly tri-sinuate. Basal foveae minute, shallow, triangular; transverse sulcus represented by a fine groove on each side of base. Disc of pronotum finely and sparsely punctured. Elytra normally convex for the genus, its umbones rather prominent, its disc coarsely and sparsely punctured.

*Holotype*: Sex? Mjöberg Coll., no locality label but very probably Borneo (Calif. Acad. Sciences).

Three other specimens with identical data are designated paratypes. A damaged specimen labeled Kalabit Co., Borneo (Mjöberg Collection, Calif. Acad. Sciences) has also been studied.

Most closely related to the Bornean species *M. brevicollis* and *apicornis* Arrow, but differs notably in the stout structure of the antennae.

*Meilichius erotyloides* Strohecker, new species

A bizarre form which looks at first glance like an erotylid but its structure is definitely endomychid. It might be referred to *Bolbomorphus* but the mesosternum is almost linearly transverse as in *Meilichius*.

Head and antennae black, the latter short and stout with segment 3 a little longer than broad, 2 and 4 to 6 quadrate, 7 and 8 transverse; club abruptly formed, its first segment about as long as broad, its second transverse, and the last very little longer than broad with its apex oblique. Pronotum deep red, its surface almost flat, irregularly punctured and with a small smooth spot on each side at base; front angles short and acute; front margin arcuately excised for reception of the head; hind angles slightly acute; basal

foveae minute. Elytra long oval, somewhat produced and sub-acuminate at apex, sparsely punctured; black, each with two large yellow marks, anterior of these encloses the humerus, leaving a circular area on the umbone black; inner margin tri-dentate. The posterior yellow marking is pre-apical and it conforms in shape to the elytron, tapering apically. In its center is a rounded black spot and it emits two rays from its anterior margin. The prosternum is very broad, deeply but not thickly punctured. Mesosternum very short, almost linearly transverse. Metasternum coarsely and sparsely punctured. Legs short and stout. Length 4.5 mm.

*Holotype*: Sex? TA HAN, HAINAN, VI-24-35, L. Gressitt (Calif. Acad. Sciences).

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## NESTING HABITS OF STENIOLIA NIGRIPES PARKER

(Hymenoptera: Sphecidae)

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In the late forenoon of April 25, 1949, the author found a colony of the bembicine wasp, *Steniolia nigripes* Parker, nesting in a small rocky valley at Yaqui Well, Borego Desert, San Diego County,

California. Since there are no published accounts of the nesting habits or prey utilized by this or any other species of *Steniolia*, observations which were made at the time may prove of interest.

The nesting site was a level patch of bare soil among the rocks of the side and approximately ten feet above the floor of the narrow valley. The soil was compact but somewhat friable, composed of a coarse, granitic sand with a powdery base. When the site was first located four female wasps were actively digging. Males were seen to visit the area occasionally, but no matings were observed. A bombyliid fly, *Lepidanthrax* sp.<sup>1</sup> was flying about six inches behind one of the females as she returned to her nest, and alighted on the ground about four inches from the nest entrance when the wasp entered. The wasp was making frequent short flights between periods of digging, and so persistent was the fly in following that she was easily captured in an insect net, along with the wasp, by swinging at the wasp in flight. The wasp was released and returned in five minutes or so, approaching her nest several times before finally entering and resuming excavation.

Nest openings, perhaps made in large part by emerging wasps, were scattered over a circular area some seven or eight feet in diameter. Toward the center, an area nineteen inches wide by twenty-nine inches long was excavated to a depth of not less than eighteen inches. Forty-one empty cocoons and one containing a live wasp were removed. The average depth of the cocoons was  $3\frac{1}{2}$  inches, with a range between  $2\frac{1}{2}$  and  $4\frac{1}{2}$  inches. Entrance tunnels were typically short and unbranched, slanting directly to the level of the cocoon, then turned to the horizontal and almost immediately expanded into an oval cell. There was also a tendency for them to deviate around rocks, and to join or ramify, possibly caused by an annual accumulation of tunnels and cells. Three cocoons were found together in an enlarged chamber beneath a buried rock, and may have been from the same or from different years.

A single bombyliid, *Aphoebantus ?hirsutus* Coq. was encountered during excavation, and had probably been stored as prey, since two others, *Aphoebantus hirsutus* Coq. and *Aphoebantus* sp., near *tardus* Coq. were taken from wasps which returned after excavation of the site had begun.

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<sup>1</sup>All Diptera kindly determined by Dr. F. R. Cole.

A NEW SPECIES OF *HAPLAXIUS*, WITH  
A KEY TO CALIFORNIA SPECIES

(Homoptera: Cixiidae)

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The genus *Haplaxius* was erected by Fowler (1904) for two Mexican species. Later, Caldwell (1946) pointed out that this name should also be applied to the species which had been included in the genus *Myndus* Stål in American literature. Caldwell includes 28 species in the genus, two of which were described from California. A third California species is described in this paper. It is one of the most distinctively marked species of the genus.

*Haplaxius gabrielensis* Flock, new species

Similar to *mojavensis* (Ball), but with basal and subbasal bands on the elytra, and lateral margins of frons more broadly expanded.

*Female*: Vertex slender, narrower at apex than at base. Frons 2.6 times as wide at apex as at base (0.19 : 0.50 mm.), wider than long (0.62 : 0.59 mm.), with a slight median carina. Pronotum two-thirds as long as eyes, and deeply, angularly emarginate posteriorly. Elytral nervures heavily setigerous; the cubitus forking far back, forming a cell only twice as long as broad; stigma cell almost semicircular.

Color, dark above and paler below. Vertex dark. Frons brownish with indication of black inside the base of the lateral carinae. Clypeus with disc brown, darker on sides. Pronotum pale with dark-brown areas behind the eyes. Mesonotum pale posteriorly, with a small dark area outside the carinae, and a large dark area on anterior half between the carinae. Elytra light, with basal dark band extending to apex of mesonotum, subapical dark band within basal third of elytra, apical third dark except for five transparent areas extending basally along some of the veins; part of apical veins white. Length, 4.12 mm.

*Male*: Dark areas considerably reduced, both in size and in intensity. Pygopher longer than wide, posterior ventral margin excavated in middle, with a short, broad, median process having a triangular apex reaching to the broadened apical portion of the style. Anal segment short, broad; ventral side concave, forming a hood over the genital capsule; telson dorsal. Styles boot-shaped, inner angle rounded, outer angle and apex truncate. Aedeagus in ventral view

with one large apical spine and a small subapical spine curving towards the anterior, and one smaller subapical spine curving in a posterior direction; in lateral view with large, erect ventral spine extending in an anterior direction. Length, 4.0 mm.

*Holotype* female, *allotype* male, and 14 *paratypes* taken from Our Lord's Candle (*Yucca whipplei* Torr.), SAN GABRIEL MTS., CALIFORNIA, at 4500 feet, July 10, 1950 (R. A. Flock). Types in author's collection. Paratypes to be placed in the collections of the University of California at Berkeley and at Riverside, in the United States National Museum, and in the Snow Collection at the University of Kansas.

#### HAPLAXIUS MOJAVENSIS (Ball)

*Myndus mojavensis* Ball, 1933 Jour. Wash. Acad. Sci. 23:480.

The types were collected at Mojave, California, on Joshua tree (*Yucca brevifolia* Engelm.) by E. D. Ball. I have since taken it in the San Jacinto Mts., California, Sept. 29, 1948, on *Agave deserti* Engelm. The specimens were compared with the type by David A. Young of the Division of Insect Identification, Bureau of Entomology and Plant Quarantine, United States Department of Agriculture.

#### HAPLAXIUS OCCIDENTALIS (Van Duzee)

*Myndus occidentalis* Van Duzee, 1914, Trans. San Diego Soc. Nat. Hist. 2:39.

This species appears to be fairly widespread in southern California. It is usually found in damp places in washes, on grasses and sedges. Several of the specimens were also taken on *Baccharis viminea* DC. The type locality is Lakeside, California, May, 1913; Van Duzee, collector. It has been taken on a sticky board hung in a citrus tree April 25 to May 9, 1947 (R. C. Dickson), during an investigation of possible vectors of "quick decline", a virus disease of citrus.

#### Key to Reported California Species

- A. Elytra with definite markings between the veins.
  - B. Elytra with markings at apex.....*mojavensis*
  - BB. Elytra with basal and subbasal dark bands
    - and apical markings.....*gabrielensis*
- AA. Elytra without definite markings between the veins.....
  - .....*occidentalis*

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## 2 NOTE ON THE SWARMING OF BRACHYMYRMEX SP.

(Hymenoptera: Formicidae)

On the evening of August 15, 1950, between 6:35 and 7:05 p.m. (Pacific daylight saving time), above the lawn on the south edge of the State Capitol Grounds at Sacramento, California, the writers observed large swarms of *Brachymyrmex* sp.<sup>1</sup> A swarm containing several thousands of the small males was first observed while looking into the direction of the sun. The central mass of the swarm was about four feet in diameter and occupied a space from about three to eight feet above the ground. Small masses of males would at times increase the speed of their frenzied dance and would form small cylinders of blurred wings and bodies which would move up and away from the larger body and after a few seconds return to the slower moving swarm. After the discovery of the first swarm an examination of the place revealed that over an area of lawn of at least 100 by 100 feet there were four additional swarms of males in flight in addition to numerous flying individuals filling the entire area. One of these swarms reached a height of approximately fifteen feet. Occasionally smaller numbers of the ants would form several small cylinders as noted above. Some males and females were noted crawling about in the grass. A few females were seen flying about and were not intimately associated with the main swarms of males. A section of shaded lawn separated from the above mentioned area by a row of trees also contained at least one large swarm which was more difficult to see because of the lack of sun due to surrounding trees. Still another swarm of *Brachymyrmex* was observed at the opposite north end of the grounds. In an adjoining fountain many hundreds of fallen specimens were observed on the surface of the water where they could not escape. Meteorological conditions: still air, bright sunlight, temperature 97 degrees F.

—P. H. ARNAUD and L. W. QUATE.

<sup>1</sup>Determined by M. R. Smith, U. S. National Museum.

ANOPHELES FREEBORNI HIBERNATING IN  
WOOD RATS' NESTS (Diptera: Culicidae)RAYMOND E. RYCKMAN and KEN Y. ARAKAWA *z.l.**School of Tropical and Preventive Medicine, Loma Linda, California*

While collecting *Triatoma* from the nests of *Neotoma fuscipes* Baird on November 27, 1950, at Redlands, California, several anophelines were observed flying from the food and dung chambers of a wood rat's nest. Five specimens of some 20 mosquitoes were collected. On examination they were found to be four females and one male of *Anopheles freeborni* Aitken; two of the females had recently obtained a blood meal. Several of the mosquitoes which were disturbed on opening the nest made definite directional flights back into the remaining portions of the nest. One may conclude from their desire to re-enter the nest that this is a preferred habitat and not one accidentally discovered by them.

On February 5, 1951, three wood rats' nests were opened in the San Timoteo Canyon, 11 miles southeast of Redlands, California. The nests were located 150 yards from suitable anopheline breeding grounds and 300 yards from the nearest cattle.

The following data were obtained from these three nests.

Nest No. 1. Twelve females of *Anopheles freeborni* present."

Nest size: 6 feet in diameter at base and 5 feet high.

Nest No. 2. Nine females of *A. freeborni*.

Nest size: 4 feet in diameter at base and 3 feet high.

Nest No. 3. Ten females of *A. freeborni*.

Nest size: 6 feet in diameter at base and 4½ feet high.

Many of the mosquitoes were in the central portion of the brushpile-like nest, being surrounded by as much as two feet of nesting material. Seventy-one per cent of the mosquitoes had plump abdomens and 29 per cent were rather slender. None of the mosquitoes had obtained a fresh blood meal for at least several days. Seriological examination is contemplated if mosquitoes are found with recent blood meals, to determine whether the hibernating females may have fed on the wood rats in the interior chambers of the nest.

These findings show that this ecological niche should be considered when endeavoring to reduce the population of overwintering anopheline females.

NEW NEVADA ORTHOPTERA RECORDS FOR  
THE 1949 COLLECTING SEASON

IRA LA RIVERS

*University of Nevada, Reno*

TETTIGONIIDAE

Tettigoniinae

ZACYCLOPTERA ATRIPENNIS CAUDELL, 1907

In the 42 years since the discovery of this species, sporadically intensive collecting has failed to extend its range beyond that of the type locality, the southern end of Walker Lake, Mineral County, Nevada. Although I have never quite believed the species could be so restricted, particularly in light of the fact that many Nevada valleys are practically carbon copies of Walker Valley, several attempts on my part to detect it beyond the confines of the valley were failures.

It might be supposed that the large Walker Lake, occupying most of Walker Valley, had something to do with creating a habitat somehow different from that of other valleys lacking bodies of water, but even a casual collecting acquaintance with *Z. atripennis* and its habits plainly showed the lake to be as non-functional as a habitat factor as if it did not exist. The large insect is a distinct arenophile, inhabiting sand dunes and sanded areas, and the plants it has been recorded from are pronounced eremophiles and widely recorded far from the vicinity of water. These plants grow practically to the rapidly receding shoreline of brackish Walker Lake, and when this 30 by 5 mile lake (175 feet deep) has completely disappeared, as it will within the lifespan of many who read this, these same eremophilous plants will grow the entire length and breadth of the valley, unless an alkaline playa occupies the flat valley floor.

However, the actual discovery of the species outside the type locality was a considerable and unexpected surprise—expecting to find it south, east or north of Walker Valley, seemingly the best possibilities in the order named, I found it two valleys to the west!

Lyon County: *Smith Valley* (highway 3 miles east of Central),  
18, 21 & 23:vii:49, elev. 4,850 ft.—La Rivers

All specimens were taken at night, three males and two females being found on the highway, and two ovipositing females in the brush some 100 yards from the highway. This locality is some 40 airline miles west-northwest of the south end of Walker Lake, and separated from it by two mountain ranges and their intervening valleys. The same plants are present although the elevation is higher. The area in which the Zacyclopterae were found is dominated by the little greasewood, *Sarcobatus baileyi*, with an abundance of saltbrush (*Atriplex confertifolia*), Indian tea (*Ephedra nevadensis*) and sand bunchgrass (*Oryzopsis hymenoides*). Along the sandy road shoulders, an occasional scrawny *Dalea polyadenia*, characteristic indicator of sand dunes and their environs, showed the effects of car movement on desert shrubs. With some slight change in percentiles, the general botanic picture was characteristically that of the animal's type locality. And the first specimens were taken only accidentally—while collecting for the much more common *Plagiostira gillettei*, which see.

In habits, Zacycloptera is more prone to bite than the equally large Plagiostira, which latter is relatively mild-tempered for such a husky, well-mandibled insect. The larger, black wings of Zacycloptera, spread down along the abdominal sides when disturbed, give the animal a more pugnacious aspect than its companion species.

In addition to its vegetarian habits, Zacycloptera, like most of its group, is avidly scavengerous when the opportunity presents itself. The first specimen taken, a female, was feeding on a car-crushed Plagiostira. While this is a common trait in tettigoniids, it is not at all remarkable, since such pronounced vegetarians as Eleodes (Coleoptera: Tenebrionidae) will feed readily on car-crushed insects.

On July 22, two ovipositing females were found during the course of night collecting, both in the *Sarcobatus baileyi* some 100 yards north of the highway, only one of which was collected. This specimen kept its ovipositor in the ground for 20 minutes after being found in spite of the bright Coleman lamp, then pulled her ovipositor from the ground and hurried off—into my cyanide bottle. Sieving the spot produced seven grayish-white eggs identical, as nearly as the eye can tell, to the eggs of *Plagiostira gillettei*, and much like those of *Anabrus simplex*. A rather cold wind was blowing gently, and a temperature reading at the oviposition site gave 69° F.

Mineral County: Yerington-Schurz highway (1 mile east of

Mineral-Lyon County line), 23:vii:49, elev. 5,500 ft.—La Rivers; *Thorne Dunes*, 23:vii:49, elev. 4,600 ft.—La Rivers.

The Yerington-Schurz highway record is that of a car-crushed specimen and constitutes the northernmost record for the species, the locale being some 38 airline miles northwest of the type locality and 25 airline miles northeast of the Smith Valley locality (33 airline miles due north of type locality baseline, and 17 airline miles due north of the Smith Valley locality baseline). Like the Smith Valley specimens, it was found at night.

The species seems to wander about on the ground only during the cooler hours after dark; the three males and one female found at the Thorne Dunes were all taken between sundown and deep dusk, and in bushes, principally *Dalea polyadenia*. Unlike those at Smith Valley, none were found wandering the ground after dark, and so the hoped-for oviposition data was not forthcoming here. I was not able to induce any of the males to sing.

CAPNOBOTES OCCIDENTALIS (THOMAS), 1872

A specimen of this small-bodied, large-winged species, common over large parts of Nevada, was found at the Smith Valley Zacycloptera locale feeding on a car-crushed *Plagiostira gillettei*. Omnivorous, it is agile enough to catch other insects in full vigor (La Rivers, 1948) and is equally a vegetarian and a carnivore.

PLAGIOSTIRA GILLETTEI CAUDELL, 1907

This large and extremely handsome insect was also found in Smith Valley for the first time, and much more commonly than at any previous Nevada locality. Once considered rare, even after being recorded from two localities in west-central Nevada (La Rivers, 1948), its appearance in what can only be described as comparatively fantastic numbers at certain spots this season makes past use of the word "rare" almost meaningless.

Lyon County: *Smith Valley* (1)—Artesia Dunes, 20:vii:49, elev. 4,800 ft.—La Rivers; (2)—highway 3 miles east of Central, 15, 18, 21, 22:vii:49, elev. 4,850 ft.—La Rivers; (3)— $\frac{1}{2}$  mile south of Hudson (Helé), 23:vii:49, elev. 4,800 ft.—La Rivers; (4)—Three Forks (3 miles north of Central), 9, 14, 16, 18:vii:49, elev. 4,800 ft.—La Rivers.

The species was first taken at the Three Forks locality, which is a small sanded area just north of the West Walker River, dominated by the arenophilous *Tetradymia comosa*, a large, strikingly pleasant bush with whitish stems and leaves and bright yellow flowers; where I have seen it in Nevada, this plant is an indicator of sanded

areas. Its principal companion plant here was the nearly equally large shadscale, *Atriplex canescens*.

Mid-day collecting at Three Forks almost immediately disclosed the presence of *Plagiostira*, and in considerable numbers, several in each bush. They were invariably hanging quietly, head up or down, and some feeding took place during this hot noon period.

The animal is slow and clumsy and easy to catch. Few showed any signs of alarm even when approached as close as three feet, and when they did decide to move, they wandered slowly and reluctantly downward along a stem. If the source of the disturbance passed on, or moved away a distance, they returned to inactivity or feeding. If an unsuccessful pass was made at an individual, it usually sufficiently excited the animal to cause it to drop, sometimes aided by a weak push from the hind legs, into the center of the bush. Few made this descent in less than several stages, but the brittle dead stems and dense living stems of the large bush were usually sufficient to save them from further persecution.

These specimens were a little more pugnacious than I had remembered them from previous Nevada collecting, and I soon found that catching them between two handkerchiefs was easier on the fingers, both from the standpoint of the occasional sharp twig encountered, and their formidable jaws, and the chance of missing the specimen was also considerably lessened. As with practically all insects which bite at all, these would bite anything within reach—one excited female swallowed the tarsi and half of the tibia of one of her middle legs, which were extracted whole only with considerable difficulty.

While most specimens here were taken from the numerous *Tetradymia comosa*, they were also common in the tops of the large and green shadscale. Typically, the heat at this part of the day registered 100° F. Night collecting at Three Forks showed that practically all specimens left the bushes and wandered about extensively on the ground during these cooler hours. Although night temperatures were pleasantly warm, *Plagiostirae* were lethargic, and even constant nudging failed to elicit more than a reluctant hop, seemingly more in indignation than fear. Such habits lead to speculations as to what protection the species has for perpetuation. Although undoubtedly possessed of parasites, none were found during the several weeks observance of the species in Smith Valley. Principal associates in this night wandering were the large tenebrionids *Eleodes obscura sulcipennis* and *E. armata*, the former predominant.

The discovery of *Plagiostirae* on the highway east of Central was accidental, and several nights collecting produced several quarts of specimens. The center of population for this particular area seemed to begin some three miles east of Central and extend the mile-and-a-half from there to the west portal of Wilson Cañon. At about the middle of this area, the topography breaks from a low central bench down to lower, rolling land toward Wilson Cañon, and the eastern edge of the bench yielded the greatest number of specimens. In this same general area, hordes of *Celerio lineata* (Lepidoptera: Sphingidae) caterpillars were marching about during the day, stripping first any and all Onagraceae to be found, then feeding on other vegetation. Unlike the Three Forks locality, this area was dominated by *Sarcobatus baileyi* and *Atriplex confertifolia* (see *Zacycloptera atripennis*) and was quite different in facies.

About a third of the highway *Plagiostirae* were taken while feeding on their car-crushed brethren, and it was found that any highway-killed animal was acceptable food—specimens were seen feeding on the remains of *Eleodes hispilabris imitabilis* (tenebrionid), *Zacycloptera atripennis*, an unidentified myrmeleonid, the large scorpion *Hadrurus hirsutus* and the remains of the common blacktailed jackrabbit, *Lepus californicus*. One lone female was noted trying to insert her long, decurved ovipositor into the asphalt. While all specimens try to bite when picked up, none make the vigorous body contortions of such as *Capnobotes* in attempts to “mandibulate” the captor. The defensive display made by spreading the intensely black hind wings down along the abdominal sides is a conspicuous element of their “fight” reaction, and many of the males sang weakly and intermittently when handled.

At this locality, *Hadrurus hirsutus* was found feeding on a non-crushed male *Plagiostira*, which it had evidently caught while prowling the highway. In addition, crushed specimens were food for *Eleodes hispilabris imitabilis*, an unidentified myrmeleonid, *Zacycloptera atripennis*, *Capnobotes occidentalis* and the gryllacrid *Stenopelmatus fuscus*.

The lone ovipositing *Plagiostira* was taken in rather rocky ground a few yards south of the highway.

At the Artesia Dunes, in northeastern Smith Valley, the species was commonly found day and night. These dunes are stationary, with a good growth of *Dalea polyadenia*, *Ephedra nevadensis*, *Atriplex canescens* and *Tetradymia comosa* and are low, long, generally north-south ridges apparently blown eastward from the shores of

the large alkaline playa, Artesia Lake, which occupies a considerable portion of the north end of Smith Valley. Unlike Three Forks, where the species was not found in vegetation during nighttime, or the Central Highway, where no specimens could be found during daytime, at Artesia Dunes they were found both in vegetation and on the ground during twilight and after dark. Two specimens *in copulo* were noted in a large Russian thistle (*Salsola kali tenuifolia*), while two additional females were found with the newly attached seminal sac still protruding unassimilated from the abdominal terminus. As many as 15 specimens were found in one medium-sized Dalea bush.

The Hudson locality was much like that at Three Forks, being on the south side of the West Walker River, with the same species of plants.

Churchill County: *Fossil Hills*, 20 mi. WSW of Fallon, 31:vii:49, elev. 4,500 ft—La Rivers; 1 mi. E. of *Mahala Sloughs*, 14:vii:49, elev. 4,000 ft.

The Mahala Sloughs specimens were collected by Miss Laura E. Mills and Mrs. J. S. Mills of Fallon, and from information obtained from Miss Mills later, it seems that the species was commoner on the highway here (U. S. 50) than in Smith Valley. The dominant plant in this region of white alkali is the large greasewood, *Sarcobatus vermiculatus*, on which the Mills saw Plagiostirae feeding. On the highway with the larger insect was the much smaller gryllacridid *Ammobaenetes lariversi*, which is known to be quite common locally on sand dunes.

At the Fossil Hills locality, several specimens were found in hot mid-afternoon in large Russian thistles growing on a series of small dunes composed of fine, very white sand. These dunes lay in a south-facing pocket in the southwest corner of the small range, at a considerable elevation above the Lahontan Valley floor, and the dominant bush was Russian thistle. This record, with Mahala Sloughs, delineates the known northwestern limits of the species' range in this part of Nevada.

In the following list of host plants, those newly added by this season's collecting are marked with an asterisk:

\**Artemisia tridentata*, *Atriplex canescens*, *A. confertifolia*,  
\**Dalea polyandenia*, \**Ephedra nevadensis*, *Oryzopsis hymenoides*,  
*Salsola kali tenuifolia*, \**Sarcobatus baileyi*, \**S. vermiculatus* and  
\**Tetradymia comosa*.

## ANOPLODUSA ARIZONENSIS (REHN), 1904

Churchill County: 6 mi. E. of *Stillwater*, 9:viii;49, elev. 4,000 ft.—La Rivers.

The discovery of this very rare insect as far north as west-central Nevada was the crowning surprise of the collecting season. Previously known only from Arizona and extreme southern Nevada, its rarity has made it an object of intense search in the past (Tinkham, 1942). The comments of Rehn and Hebard (1909) concerning the single specimen they caught on the Nevada side of the Nevada-California state line could be applied with hardly a change in wording to the solitary *Stillwater* specimen. Both localities are foothill slopes of volcanic hills, and both specimens were flushed from bushes, "greasewood" in the case of southern Nevada, saltbrush (*Atriplex confertifolia*) at *Stillwater*. The species' former distribution seemed to indicate it was restricted to creosote areas (*Larrea divaricata*); the *Stillwater* discovery, approximately 300 airline miles northwesterly of its southern Nevada locality, adds the extensive shadscale area to the species' life zone. *Stillwater* is some 150 airline miles northwesterly from the northwestern limit of creosote in Nevada's Sonoran Trailway (for a brief resumé of this Trailway, see La Rivers, 1948:654).

My attention was attracted to the female specimen by the activities of a small Western collared lizard (*Crotaphytus collaris baileyi*) hunting near the top of a saltbrush (*Atriplex confertifolia*). As I watched, the lizard flushed a large yellowish orthopteran which flew strongly to another bush about 100 feet away, where it was caught. Two days and one night were spent combing a vicinity of about a square mile for other specimens, without success. The two dominant plants of the gradual slope are the mentioned *Sarcobatus baileyi* and *Atriplex confertifolia*. The slope itself is composed of soft alkaline dust—Pleistocene Lake Lahontan sediments—covered with the typical desert pavement of volcanic stones and pebbles.

The specimen was not quite so prone to bite as is the similarly-built *Capnobotes occidentalis*.

It seems expedient, at this point, to mention an additional specimen for California. Tinkham (1942) recorded a badly disintegrated individual from Yermo in southern California, in the collection of the state quarantine station there. I recently noticed a fine female specimen in the collection of the Division of Entomology and Parasitology of the University of California at Berkeley with

the following data: San Bernardino County: *Yermo Quarantine Station*, 3:vii:49, elev. 1,935 ft.—Warren Leigh. It was taken in early evening, presumably at light.

### GRYLLACRIDIDAE

#### STENOPELMATUS FUSCUS HALDEMAN, 1852

Lander County: 8 mi. E. of *Austin*, on U. S. 50, 2:ix:49, elev. 5,500 ft.—La Rivers and T. J. Trelease; Lyon County: *Smith Valley*—(1)—Artesia Dunes, 20:vii:49, elev. 4,800 ft.—La Rivers—(2)—highway 3 mi. E. of Central, 18:vii:49, elev. 4,850 ft.—La Rivers.

The above records add two more counties to those already listed for the State (La Rivers, 1948). The animal certainly occurs in every county of the State. All specimens were found wandering after dark, the Lyon County individual feeding on a car-crushed *Plagiostira*.

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### BOOK NOTICE

INSECTS IN YOUR LIFE. By C. H. Curran. Sheridan House, Inc., New York, 316 pp., illustrated. 1951. Price \$3.50.

As the title suggests, insects cannot be entirely divorced from the human race. They have been associated with man ever since he first laid aside a few acorns, a bit of smoked meat and a supply of hides to cover his back. Good or bad, they are reluctant to be disassociated from either animal or plant life. Dr. Curran has written a graphic and excellent account of some of the closer contacts we have with insects. To fully appreciate his viewpoint, the reader must cast away all hearsay prejudices and assume an attitude of confidence in words of a well educated and experienced entomologist. It must be borne in mind, too, that these few examples are only fragments of what may be written on behalf of or against these tiny creatures that have had some two hundred million years more experience on this earth than we humans.

Because of the great abundance of insects everywhere indoors and out, people, young and old, should become acquainted with their looks and ways. And this book offers the chance to get started. Its pages are full of charm and wisdom—charm that causes one delight in understanding the ways of dragonflies and butterflies and the wisdom needed to recognize and to know how to control clothes moths, termites, bot flies and numerous other insect pests. "Ticks are a Menace to Animal Life"; "Butterflies are Big Game"; "The Yucca Moth the World's First Horticulturist" writes Dr. Curran. And if you are not too squeamish, be sure to read the chapter, "On Eating Insects" so that you may continue the daily consumption of insects with much more understanding and relish; and who knows, perhaps insects contain more food vitamins than a doctor's prescription.

Insects furnish one of the most marvelous examples of the purpose and spontaneity of life and without insects and flowers this would be a dull world.

Dr. Curran has also written an important systematic work on "North American Diptera" and another popular book: "Insects of the Pacific World." I recommend most highly all of these.

—E. O. ESSIG

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## THE MODIFIED HIND WING OF EUGLOSSA

(Hymenoptera: Apoidea)

URLESS N. LANHAM

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The hind wing of the aculeate Hymenoptera characteristically has two lobes on the posterior margin: the vannal lobe, limited exteriorly by the vannal (= preaxillary) incision, which usually coincides with the end of the vannal vein, and the more proximal jugal (= anal) lobe, limited by the jugal (= axillary) incision, which is usually in line with a more or less chitinized fold near the base of the wing. One or another (rarely both) of these lobes is frequently secondarily absent. Thus, the jugal lobe is absent in the more advanced mutillids, all but the most primitive ants, and certain vespid and sphecoid wasps, as set forth in Bradley's well-known key to the families of the Clistogastra, in Comstock's "An Introduction to Entomology." In the Apoidea, the jugal lobe is absent in *Bombus*, and in the Euglossini. The tribe Euglossini

comprises five genera, both pollen-collecting and parasitic forms, which are limited to the New World, and are mainly tropical.

Although the jugal lobe is missing in *Euglossa*, the space which should be occupied by the lobe is in part filled by a brush formed by a dozen or so strong bristles arising from a basal thickening of the vannal vein. These bristles lie in a single row, but some of the bristles are bent, so that the surface formed is curved. I have seen no reference to any such structure in the Hymenoptera, and term

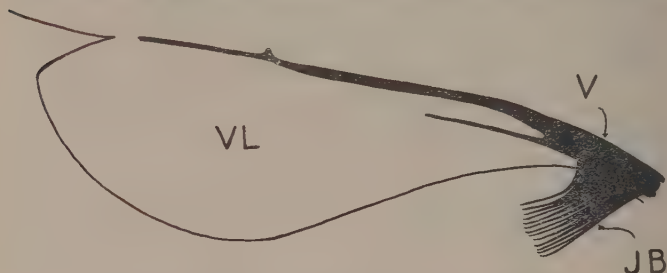


Fig. 1. Portion of base of hind wing of *Euglossa*. JB, jugal brush; V, vannal vein; VL, vannal lobe.

it the *jugal brush*. In at least some species of *Euglossa*, the brush is fairly large and conspicuous, and one could imagine that it might serve the same function as the jugal lobe. However, in *Eulaema* and *Exaerete* the brush is quite small in relation to the area of the wing. Although the jugal brush might be analogous to the jugal lobe, it is certainly not homologous to it, since the bristles are not formed by a breakup of the wing membrane. The presence of a basal lobe on the trailing edge of the flight surface is quite characteristic of the more powerfully flying groups of Diptera and Hymenoptera, and presumably is of some aerodynamic significance.

Morphologically, the Euglossini are among the most remarkable of bees, Michener (1944, Comparative external morphology, phylogeny, and a classification of the bees (Hymenoptera). Bul. Amer. Mus. Nat. Hist. 82:290) describes the unique tentorium of *Euglossa*. In addition, the extensive velvety area (possibly sensory or scent-dispersing) on the anterior surface of the middle tibia in males, and the partially or almost entirely enclosed pubescent area on the hind tibia of the males are not, to my knowledge, known outside the tribe.

I am indebted to Dr. T. H. Hubbell for the use of specimens in the collection of the University of Michigan Museum.

## SOME NEW WORLD XYLOTINAE

(Diptera: Syrphidae)

F. M. HULL

*University of Mississippi*

Several interesting species of Syrphid flies belonging to the subfamily Xylotinae have recently been discovered among miscellaneous material. These flies are here described. The genus *Crepidomyia* is neotropical; heretofore only four species have been known.

*Crepidomyia dion* Hull, new species

Related to *C. darlingtoni* Hull. There is no spur on the hind tibiae. The wings are quite dark, but the general color is blue-black. There are no yellow spots upon the second abdominal segment. Length 13.5 mm.

Female. *Head*: the face, cheeks, front, vertex and occiput are black. There is a narrow band of white pubescence along the sides of the face adjacent to the lateral carina. The lateral and medial carina are quite sharp. There is a transverse band of whitish pollen across the middle of the front expanded somewhat near the eye margins; this band when viewed anteriorly becomes pale brown in front of the ocelli. The immediate rim of the preantennal callus and the inner portion of the antennal pits are light yellowish-brown. The antennae are black, the arista missing; antennal pile black. The pile of the upper front is black; across the middle front it is whitish and the few hairs of the face are white. The occipital pollen is greyish-white; the pile is whitish becoming black dorsally. *Thorax*: the mesonotum is quite dull black, a little more shining upon the postcalli, the area in front of the calli and upon the scutellum. There are only very faint traces of pollinose vittae submedially and sublaterally upon the mesonotum, but there is a prominent yellowish white triangle of pollen medial to and adjacent to the humerus; it becomes evanescent after curving around behind the humerus. The transverse suture is conspicuously margined with pollen of the same color which reaches only to the notopleura. The mesonotum, including the scutellum, is densely covered with appressed black setae and has scattered longer black hairs. The scutellar fringe is quite copious and white. The pleura are shining black with thinly dusted whitish pollen and only scattered white hairs. The squamae are greyish-white basally but widely blackish-sepia along the margin and fringe. Halteres reddish-orange. *Legs*: entirely black except the hind basitarsi which are perhaps dark reddish to orange-brown and pale yellow pilose.

The hind femora are moderately thickened in the middle with heavy spines throughout their length. The hind trochanters have a short, sharp, black spur apically. The hind tibiae end without spur. *Wings*: deeply sepia-brown beginning at the base of the submarginal cell, becoming paler on the discal cell and at the apex of the wing. The pterostigma is still more blackish except towards the apex where it too becomes pale. The small cross vein is slightly recurrent apically, pulled out apically and hence oblique, and joins the discal cell beyond the middle. The third vein is gently curved backward. The marginal cell is opened as wide as its apical width; the whole basal portion of the wing is pale brown with slight yellowish cast with the exception of the basal portion of the marginal cell and extreme base of the basal cells which are almost hyaline. The wings have a distinct purplish reflection, greatest when viewed from the ventral surface and greater from the blackish areas. *Abdomen*: slightly widest upon the third segment which has approximately parallel sides; the fourth segment is a little narrowed. The fifth segment is creased upon the outer third near the middle creating the impression of two segments. The entire abdomen is dully shining black and slightly greasy. The pile is short, appressed, black, but yellow laterally on the sides of the first and second segments, in the middle posteriorly on the fourth segment and upon all of the fifth segment.

*Holotype*: female, CHANCHAMAYO, PERU, Jan. 3, 1949. J. Schunke. Type in author's collection.

### *Crepidomyia cybele* Hull, new species

Distinct in the stripes of golden appressed pile on the mesonotum and the light brownish-orange face. Not closely related to other species. Length 12.5 mm.

Female. *Head*: the face is light brownish-orange with dense golden pubescence reaching almost to the blunt medial carina and the blunt lateral carina. The cheeks are brassy black; the front is black and quite brassy in reflection with an obscure band of golden-brown pollen across the middle of the front and pale yellow pile which is more or less concentrated in an oval patch along the eye margin on each side of this band. Just before the narrow pre-antennal callus there is a transverse depression. The vertex is shining black, greenish to brassy in reflection with seven black hairs behind and perhaps as many in front. The first segment of the antennae is blackish, the second is dark brown, the third missing; the facial pile is yellow and the occiput brassy black, yellowish pollinose with pale brassy pile throughout. *Thorax*: the mesonotum is black with a broad, medial, posteriorly furcate, faint, reddish sepia pollinose vitta and still more faint similar ones sublaterally; the lateral margins throughout and the medial vitta, at least upon the

anterior half is densely appressed, greenish brassy pilose; the pleural and scutellar pile is of the same color; the reflection of the scutellum is brassy, its apex with deeply crimped margin and copious, conspicuous, brassy ventral fringe. Squamae and fringe and halteres pale orange. The anterior and middle legs, except for coxae and trochanters, are entirely bright clear egg-yellow with similarly colored pile. The hind femora are yellowish-brown basally, becoming reddish through the middle, still darker at the apices, their pile golden except apically, their ventral margins with nine stout, sharp, black, spinous setae. The hind tibiae are nearly blackish but actually dark reddish-sepia, especially ventrally and basally; their pile is black, except for a short streak of golden hair baso-laterally and medio-apically. The hind tibiae have two stout, bidentate, short, spinous processes, deep cleft between. Hind tarsi yellowish-brown, most of their dorsal pile golden. *Wings*: almost uniformly tinged with pale yellowish-brown; the costal cell and the first basal cell are light yellow; the pterostigma is deep yellow except apically; the marginal cell is opened as wide as its apical width; the third vein is more gently concave than in *dion* n. sp; the small cross vein is more oblique, not recurrent, entering the discal cell barely beyond the middle. *Abdomen*: black, but shining brassy to purplish on the first segment and the sides of the second, third and fourth segments. These latter segments are broadly opaque black down the middle and the opaque color is expanded posteriorly to include most of the posterior margin and anteriorly expanded only upon the second and fourth segments. Pile upon the brassy areas and sides long, erect and pale yellow. Upon the black areas short, black and quite appressed.

*Holotype*: female, CHANCHAMAYO, PERU, Jan. 20, 1949, J. Schunke. Type in author's collection.

#### *Nepelas sapphirina* Hull, new species

Related to *bidens* Curran. The third abdominal segment is wholly shining green without opaque areas or subbasal reddish-brown bands. The second segment has a strong bluish cast especially anteriorly and laterally. Hind femora strongly bluish basally, greenish apically. Length 10.7 mm.

Male. *Head*: face black except above the epistoma where it is pale yellow. The cheeks are black; the front is brassy black and bare upon a broad rectangle lying upon the lower half of the front. The upper half of the front is linearly notched antero-medially and the sides of the front and the whole of the face are pale yellowish-white pubescent. The frontal and facial pile is yellowish-white; the face has a sharp medial carina. The first two segments of the antennae are nearly black; the third is elongate, twice as long as its basal width; it is a little more narrow on the apical half and black with the base dull reddish, the pile white. The vertex is dully shining black with the area across the front of the ocelli opaque blackish and the

anterior half of the vertical triangle yellowish white pollinose and yellow pilose. All vertical pile and all occipital pile pale; the upper occipital hairs are more deeply yellow or reddish-yellow. The eyes touch for about ten facets; the anterior facets are considerably enlarged. *Thorax*: the mesonotum is black, rather shining, with three faint, coppery vittae, the region between is faintly greenish; the post calli and the scutellum have bluish reflections; the mesonotal pile is short, erect and black with vittae of pale brassy pile. There is a pair of wide, widely separated, brassy stripes which begin anteriorly but become quite slender at the base of the scutellum; they merge into a transverse, wide band of similarly colored pile in front of the scutellum. There is a narrow medial vitta, a sutural marginal vitta and a sublateral stripe running from the suture back to the scutellum, all of pale yellow pile. The pile in front of the suture is thinly yellowish and there is a conspicuous, yellowish-white patch of pollen bordering the humerus medially. The scutellar pile is abundant and pale yellow. The pleura are bluish black with nearly white pile. The white squamae have a blackish sepia border and fringe. Halteres yellowish. *Legs*: the anterior and middle femora are quite black; their apices are narrowly brownish-yellow. Hind femora are immensely thickened, shining black with bluish reflections, very dark reddish-brown at the apex, with five apico-lateral, sharp, black spines ventrally. The pile of the femora for the most part is nearly white. The anterior and middle tibiae are black but light yellow diffusely on the basal fourth or less. The first two segments of anterior and middle tarsi are yellowish white; remaining segments black. Hind tibiae black, the base narrowly whitish, the dorsal pile whitish, the ventral pile short and black. These tibiae are quite concave with knife-edge both basally and apically; the ventral spur is quite long and flattened, rounded and pale at the apex. The hind tarsi are black on the last four segments, sepia on the basal one, the dorsal pile pale. *Wings*: greyish hyaline, the pterostigma dark brown. *Abdomen*: slightly narrowed at the end of the second segment. The second segment is long; it is one and three-fifths longer than its posterior width and distinctly emarginate and except at the apex, with a deep shining blue reflection. Viewed from the rear this segment is dully opaque through the middle and more widely at base and at apex. The first segment is black, dully shining, transversely striate with faint bluish reflections. The second segment is also markedly striate. Third segment and the fourth entirely shining greenish brassy in color. The pile is yellowish white basally becoming black along the posterior margin except at the sides. All of the pile of the fourth segment is brassy-yellow. The fourth sternite is crimped into a thin median ridge. Pile of first and second segments whitish along the sides.

*Holotype*: male, CHANCHAMAYO, PERU, August 1, 1948, J. Schunke. *Paratypes*: two males, same data. Types in author's collection.

A SATISFACTORY TECHNIQUE FOR  
REARING AGROMYZID FLIES FROM THE  
LEAF MINING LARVAL STAGE<sup>1</sup>

(Diptera: Agromyzidae)

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Rearing adults from mined leaves containing larvae is the most desirable method of collecting these small flies. Host records, mined leaves, larvae, and puparia, as well as the adults, are all valuable as aids in separating the many closely related species found in a number of genera, particularly *Liriomyza* Mik and *Phytomyza* Fallén.

The literature concerning the rearing of agromyzids is scant. Inchbald (1881) found the adults not difficult to rear, "if the collector will only imitate Nature in her ways and means." He found that an occasional light sprinkling of water was needed to supply moisture normally provided by rain or dew. Frost (1924) placed the mined leaves individually into small, round, seamless tin boxes or in tissue paper triangles as the mined leaves were collected in the field. The paper triangles were kept in a tin box. Upon returning to the laboratory, all larvae that had emerged and pupated were placed individually in small, one-dram vials, corked to prevent evaporation. With those species which pupated in the mines, a small section of leaf containing the pupa was cut out and placed in a stoppered vial.

In spite of the relatively dry climatic conditions occurring in California, lack of humidity was found to be the limiting factor when rearing the various species in the laboratory. None of the larvae of the numerous species reared by the writer was known to leave a desiccated leaf, crawl to another, and begin a new mine. Therefore, it was necessary to devise a method to keep the leaves fresh for a period of four or five days until the larvae had emerged or pupated at the end of the mine.

<sup>1</sup>Published as Scientific Paper No. 915, Washington Agricultural Experiment Stations, Institute of Agricultural Sciences, The State College of Washington, Pullman.

Leaves containing mines of a particular species were gathered with petioles as long as possible. The collected leaves were segregated as to mine type, and kept in paper bags containing a damp paper towel and held shut by paper clips. Mines of all ages were included. Those from which the larvae had emerged were pressed in a standard plant press. The smaller, newer mines, although more difficult to detect, were preferred because parasitism by braconid and chalcidoid parasites became a crucial factor in rearing flies from mature larvae. Freshly externally parasitized larvae, *i. e.*, those that were motionless, but not discolored, made satisfactory specimens for preserving in alcohol.

Upon returning to the laboratory, the writer separated the leaves which were to be kept fresh from the others. The petioles were clipped back one-eighth to one-fourth of an inch from the original breaking point and the leaves immediately placed in water. The petioles of two to six leaves, depending upon the size, were then rolled together in wet cotton strips making a firm plug that could be forced into the top of a vial of water (fig. 1). To prevent the emerging larvae from falling to the water around the cotton plug and drowning, the vials were inverted.

Each vial was supported by a piece of wire—straightened paper clips proved convenient—having one end clamped around the neck of the vial. When the cotton plugs were fitted firmly, no leakage of water occurred. Each vial or series of vials holding leaves mined by the same species was then placed in a wide mouthed one-half pint or one pint jar. The lids of the jars previously had been cut out near the rim and covered with a fine mesh cloth. The vials were removed immediately after all larvae had emerged. The leaves frequently made satisfactory herbarium specimens. An inverted vial of water plugged with cotton was usually placed in the jars to increase humidity.

Some adults failed to emerge, particularly of those species whose larvae mine the leaves of plants associated with damp situations. As a result, it was found necessary to add about half an inch of fine, washed sand to the bottom of each jar. The sand was kept moist by adding water as needed, until all adults had emerged.

For economy of space, the pupae of each species passing through a winter diapause were placed in a small numbered vial covered with a fine mesh cloth held in place by a rubber band. As many

vials as possible were then placed upright in the jars, and the bottom of each jar was kept covered with about half an inch of water. With the cloth lids on the jars, the humidity remained sufficiently high to prevent pupal desiccation.

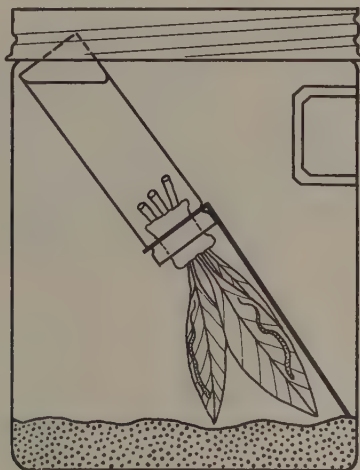


Fig. 1. Diagram of a rearing jar. The inverted vial within is supported by a piece of wire. Damp sand covers the bottom of the jar.

When a great number of leaves mined by a single species were encountered, as was often the case when agricultural crops were attacked, a high percentage of adult emergence was obtained simply by filling jars of suitable size (gallon jars often being required) with the mined leaves. The humidity created by the decomposing vegetation was sufficient to keep the leaves fresh until the larvae had emerged and pupated. Care was taken, however, to keep any liquid in which the pupae might have drowned, from collecting on the bottoms of the jars.

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## A METHOD FOR TAKING APHIDS IN FLIGHT

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It has long been the practice for entomologists to make aphid flight studies by the use of "sticky traps". This requires the removal of the aphids from the adhesive material, a process which, as those of us that are called upon to make the determinations know all too well, often results in irreparable damage to the specimens. I have had no practical experience with aphid traps, nor have I been able to check the literature; however, I have long had the idea that a more effective method of making aphid flight studies would be welcomed by economic entomologists.

Last fall a chance observation of many aphids resting on a turkish towel hanging on a clothes line rekindled this thought. The towel was a deep yellow and by chance was hanging next to a pale blue one, which in turn was followed by white ones. The blue towel and the white ones had hardly any aphids on them, in sharp contrast to the yellow which had many. Experiments to determine if aphids had a color preference for yellow were set up, and carried through the month of October and into November, thus covering the height of the fall aphid migration. It was determined that at no time was the yellow towel less than three times as effective as the blue in attracting aphids, and often ten times. The blue towel was about twice as effective as the white, in fact the aphids on the white towels were so few that perhaps they landed there by chance. A typical count for a given twenty-minute period was 72 for the yellow, 8 for the blue and 2 for the white.

The aphids seemed reluctant to take flight from the surface of the towels and walked with difficulty over their shaggy surface. This indicates that once caught they were at least temporarily trapped. Specimens could be picked off readily without damaging them. Only once were specimens mounted for study; they belonged to the following genera: *Aphis*, *Macrosiphum*, *Amphorophora*, *Pemphigus* and *Prociphilus*.

Considering that Turkish towels have two effective surfaces, have considerable area, that aphids seem reluctant to take flight from their surface, and that aphids apparently show a color preference, towels appear to warrant further investigation as aphid traps.

## REARING THE GREENBOTTLE FLY ON DOG BISCUITS

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The greenbottle fly, *Phaenicia sericata* (Meigen), was successfully raised on dog biscuits in the laboratory, following the method described by Frings (1947, 1948), with a few modifications. "Milk Bone Small Size Dog Biscuits," manufactured by the National Biscuit Company, was the brand used. The small size dog biscuits gave better results than the "Milk Bone Tiny Bits," as there was less packing of the medium. The addition of powdered milk as a source of protein for the adults to feed on increased egg production, and the flies started oviposition sooner than when fed only on moist dog biscuits.

The laboratory colony was started by caging wild flies and feeding them on powdered milk and moist dog biscuits. Three and one-half dog biscuits were placed in a 50 ml. beaker filled with water, and left in the cage for 24 hours for the flies to oviposit on. The mass of eggs and dog biscuits was then placed on top of the prepared larval food.

To prepare food for the larvae, dog biscuits were placed in a gallon jar to a depth of two inches, covered with water and allowed to stand until soaked through; then the water was poured off. The biscuits were soft to the touch throughout when ready; the time it took for the water to soak through the dog biscuits varied from one batch to another. Fine wire screen was used to confine the maggots to the jars. If the population of maggots was too high for the available food, additional moist dog biscuits were added at the rate of two inches at a time.

The maggots fed for six to seven days at 80 degrees F. Coarse sawdust was added on top of the mixture for the maggots to pupate in. After pupation the sawdust containing the puparia was poured out and placed in cages for emergence.

Very little odor was noticed during the rearing of the flies. After the maggots left the media to pupate, decomposition odors were noticed but these were held back by the sawdust.

<sup>1</sup>Published with the approval of the Director of the Idaho Agricultural Experiment Station as Research Paper No. 324.

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1947. A simple method for rearing blowflies without meat. *Science*, 105 (273) : 482.

FRINGS, H.

1948. Rearing houseflies and blowflies on dog biscuit. *Science*, 107 (2789) : 629-630.A NOTE ON THE MANNER OF FEEDING OF  
*AGULLA ADNIXA* HAGEN

(Raphidiodea: Raphidiidae)

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In feeding, this species devours aphids entirely, swallowing all parts and rejecting nothing. The prey is masticated rapidly and then swallowed with a gulping motion. An adult female, placed in a vial containing a twig with fifty-seven aphids, began at the bottom of the colony and ate it entirely in less than nine minutes.

Feeding is systematic and rapid. The head is passed among the foliage and surfaces palpated with both pairs of palpi. Sight appears to play but little part in the location of prey. Upon touching an aphid, the head is then withdrawn and the long pronotum arched back, and the head then darts forward with great speed, in a snake-like movement that is nearly too fast to follow. The prey is grasped by the mandibles and the head is raised slightly and withdrawn. The mandibles work rapidly and rhythmically while the palpi, for the most part, are not applied to the victim once it is captured, but are vibrated rapidly.

The gular sutures are very flexible and may be seen to give to some extent as swallowing takes place. After the colony was eaten, a second inspection of the twig took place, very carefully done, to be sure that no further prey remained. Subsequently, an extended period of grooming and adjustment of appendages followed, including raising, lowering and extension of the wings, without any attempt to fly. A period of apparent torpidity then ensued, and no further activities followed during the remainder of the day.

Next morning the raphidid appeared to be as hungry as before, and repeated the entire process in a similar manner with another aphid colony. This behavior indicates a very effective predator.

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